

Appl. No. : 10/758,355
Filed : January 15, 2004

REMARKS

The following remarks are responsive to the April 20, 2006 Office Action. Claims 1, 8, 10, and 12 remain as previously presented and Claims 2-7, 9, and 11 remain as originally filed. Thus, Claims 1-12 are presented for further consideration.

Response to Rejection of Claims 1-7, 9, and 12 Under 35 U.S.C. § 103(a)

In the April 20, 2006 Office Action, the Examiner rejects Claims 1-7, 9, and 12 under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,691,978 issued to Kenworthy ("Kenworthy") in view of U.S. Patent No. 6,421,377 issued to Langberg et al. ("Langberg").

Claim 1

As previously presented, Claim 1 recites (emphasis added):

1. A transceiver comprising:
 - a receiver receiving a signal and generating a receiver signal having a receiver bandwidth;
 - a receiver direct converter translating the receiver signal to a baseband of the receiver signal and digitizing the translated, receiver signal;
 - an adaptive canceller comprising a reference direct converter, the reference direct converter outputting a digitized transmit signal reference of a spectral energy of a transmitter, **the digitized transmit signal reference having the receiver bandwidth;** and
 - a matched filter, wherein the receiver direct converter, the reference direct converter, and the matched filter suppress the spectral energy of the transmitter from the receiver signal.

As described in the present application at paragraph [0060], referring to Figure 5A, "The transfer function $H_{REF}(\omega)$, of the reference bandpass filter 236 preferably matches the transfer function $H_{RX}(\omega)$, of the receiver bandpass filter 214." Thus, the present application teaches that in certain embodiments, the digitized transmit signal reference has the same bandwidth as the receiver bandwidth of the receiver signal. However, Applicant submits that neither Kenworthy nor Langberg discloses a "digitized transmit signal reference having the receiver bandwidth," as recited by Claim 1.

In the April 20, 2006 Office Action, the Examiner acknowledges that Kenworthy does not disclose the "digitized transmit signal reference having the receiver bandwidth." The Examiner cites Langberg in arguing that Langberg discloses a "digitized transmit signal reference having the receiver bandwidth." However, Applicant respectfully submits that the passages of Langberg cited by the Examiner do not disclose this limitation. For example, Langberg at column 5, lines 59-65 discloses (emphasis added):

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In this regard, an apparatus 100 is provided having a **transmit path 102 for communicating data within a first bandwidth, a receive path 104 for communicating data within a second bandwidth**, and an adaptive echo canceler 180 disposed between the transmit path 102 and the receive path 104.

Applicant submits that nowhere does Langberg disclose or suggest that the first bandwidth is equal to the second bandwidth.

The Examiner further cites Langberg at column 6, lines 27-32, which discloses (emphasis added):

Therefore, a receive signal of 2.208 mega samples per second is decimated to a rate of 552 kilo samples per second. A similar decimator circuit 110 is disposed between the transmit path 102 and the echo canceler 180 to decimate the transmit signal from 2.208 mega samples per second to 552 kilo samples per second at output 114.

Applicant submits that while this passage of Langberg discloses that the receive and transmit signals have the same sampling rate, Langberg is silent regarding the receive and transmit signals having the same bandwidth.

To the extent that the Examiner is interpreting sampling rate to be synonymous with bandwidth, Applicant respectfully submits that the term "bandwidth" is used in the present application to mean something entirely different from sampling rate. The present application relates to canceling transmitter signal energy in a receiver bandwidth in wireless communications. As disclosed by the present application at paragraph [0045], lines 5-9 (emphasis added):

Figure 2A also shows **transmit spectral spillage 406 in the receiver bandwidth 402** from a single channel. In other words, noise 406 from the transmitter 280 (Figure 1) leaks (spills) into the receiver 106 and raises its noise figure. The canceller 230 of the Figure 1 is designed to **cancel this transmit noise 406 within the receiver bandwidth 402**.

Thus, the term "bandwidth" is used in the present application to refer to the range of frequencies of interest of a signal, not the rate of data transmission. Furthermore, the present application at paragraph [0046], lines 1-5, describes (emphasis added):

Figure 2B illustrates a multiple-channel system with a plurality of transmitted signal powers 404', 404'', 404''', a **receiver bandwidth 402** and a plurality of received communication signal powers 404', 404'', 404'''. Figure 2B also shows **transmitter spectral spillage 406 in the receiver bandwidth 402** from multiple channels (multiple transmit signals and multiple receive signals).

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These passages, as well as Figures 2A and 2B, make clear that the term “bandwidth” is used in the present application to refer to a range of frequencies of interest of a signal, and in particular, the term “receiver bandwidth” refers to a range of frequencies of a receive signal.

The Examiner also states that Langberg discloses the use of an identical filter to filter both the transmit reference signal as well as the receive signal. However, Applicant respectfully submits that the reference does not disclose an identical filter, but rather an identical decimator, which are distinctly different devices. A decimator reduces the sampling rate of a digital signal. Hence, as Langberg at column 6, lines 25-33, discloses by way of example, a receive or transmit signal of 2.208 mega samples per second is decimated to 552 kilo samples per second by a decimator with a four to one ratio. However, if the transmit and receive signals are at two different sampling rates, then two identical decimators will output two signals with different sampling rates. For example, when a transmit signal of 2.208 mega samples per second, and a receive signal of 552 kilo samples per second are passed through two identical decimators with a four to one ratio, the transmit signal is decimated to a rate of 552 kilo samples per second and the receive signal is decimated to a rate of 138 kilo samples per second.

The reference and receiver bandpass filters described in the present application (see, *e.g.*, paragraphs [0045]-[0048], [0054]-[0060]) operate in a different manner than the decimators disclosed by Langberg. For example, the present application at paragraph [0045], lines 3-4, states:

Figure 2A also illustrates a receiver bandwidth 402 from a receiver bandpass filter, such as the receiver bandpass filter 214 described below with reference to Figure 5A. The receiver bandwidth 402 is designed to pass the received signal 404 but not the main transmit signal 400.

Bandpass filters ideally pass frequency components of a signal that are within the bandwidth of interest, *i.e.*, within a desired range of frequencies, and reject components of a signal that are outside the bandwidth of interest, *i.e.*, outside the desired range of frequencies. Decimators do not operate this way. Thus, Langberg does not disclose or suggest a “digitized transmit signal reference having the receiver bandwidth,” because Langberg discusses sampling rates modified by decimators, not bandwidths which can be determined by bandpass filters.

For at least the foregoing reasons, Applicant submits that Claim 1 is patentably distinguished over the combination of Kenworthy in view of Langberg. Applicant respectfully requests that the Examiner withdraw the rejection and pass this claim to allowance.

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Claims 2-7 and 9

Each of Claims 2-7 and 9 depends from Claim 1, so each of Claims 2-7 and 9 includes all the limitations of Claim 1, as well as other limitations of particular utility. For at least the reasons stated above with regard to Claim 1, Applicant submits that each of Claims 2-7 and 9 is patentably distinguished over the combination of Kenworthy in view of Langberg. Applicant respectfully requests that the Examiner withdraw the rejections of Claims 2-7 and 9 and pass these claims to allowance.

Claim 12

As previously presented, Claim 12 recites (emphasis added):

12. A transceiver comprising:
a duplexer coupled to an antenna;
a receiver having a receiver bandwidth, wherein the receiver receives a first signal from the duplexer, **the first signal having the receiver bandwidth;**
a transmitter sending a second signal to the duplexer, **the second signal having the receiver bandwidth;** and
an adaptive, digital, coherent spectral canceller coupled to the receiver and the transmitter, the canceller attenuating a signal spectrum leakage of the second signal within the receiver bandwidth.

For reasons similar to those discussed above with respect to Claim 1, Applicant submits that Claim 12 includes limitations which neither Kenworthy nor Langberg disclose or suggest. For example, Applicant submits that neither Kenworthy nor Langberg discloses or suggests “the first signal having the receiver bandwidth” and “the second signal having the receiver bandwidth” as recited by Claim 12. Therefore, Applicant submits that Claim 12 is patentably distinguished over Kenworthy in view of Langberg. Applicant respectfully requests that the Examiner withdraw the rejection of Claim 12 and pass this claim to allowance.

Response to Rejection of Claim 8 Under 35 U.S.C. § 103(a)

In the April 20, 2006 Office Action, the Examiner rejects Claim 8 under 35 U.S.C. § 103(a) as being unpatentable over Kenworthy in view of Langberg and in further view of U.S. Patent No. 5,396,571 issued to Yedid et al. (“Yedid”). Applicant submits that Yedid does not disclose or suggest the limitations of Claim 1 which are not disclosed or suggested by either Kenworthy or Langberg. Therefore, Claim 1 is patentably distinguished over Kenworthy in view of Langberg and in further view of Yedid.

Claim 8 depends from Claim 1, so Claim 8 includes all the limitations of Claim 1, as well as other limitations of particular utility. Therefore, for at least the reasons stated above with

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regard to Claim 1, Applicant submits that Claim 8 is patentably distinguished over Kenworthy in view of Langberg and in further view of Yedid. Applicant respectfully requests that the Examiner withdraw the rejection of Claim 8 and pass this claim to allowance.

Response to Rejection of Claims 10 and 11 Under 35 U.S.C. § 103(a)

In the April 20, 2006 Office Action, the Examiner rejects Claims 10 and 11 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,596,439 issued to Dankberg et al. ("Dankberg") in view of Kenworthy and in further view of Langberg.

Claim 10

As previously presented, Claim 10 recites (emphasis added):

10. A method of attenuating a transmitter signal spectrum within a bandwidth of a receiver, the method comprising:

digitizing a received signal from a receiver, **the received signal having a receiver bandwidth**, the received signal corrupted by components of a transmit signal;

creating a digitized reference transmit signal of the transmit signal, **the digitized reference transmit signal having the receiver bandwidth**;

aligning the digitized reference transmit signal in amplitude, phase and time delay with the digitized received signal;

subtracting the digitized reference transmit signal from the digitized received signal to form a residue; and

suppressing a transmitter spectral signal power of the residue within the receiver bandwidth.

In the April 20, 2006 Office Action, the Examiner acknowledges that Dankberg discloses neither the limitation of "the digitized reference transmit signal having the receiver bandwidth," nor the limitation of "suppressing a transmitter spectral signal power of the residue within the receiver bandwidth." For reasons similar to those discussed above with respect to Claim 1, Applicant submits that neither Kenworthy nor Langberg discloses or suggests the limitations of Claim 10 which are not disclosed or suggested by Dankberg. Therefore, Claim 10 is patentably distinguished over Dankberg in view of Kenworthy and in further view of Langberg. Applicant respectfully requests that the Examiner withdraw the rejection of Claim 10 and pass this claim to allowance.

Claim 11

Claim 11 depends from Claim 10, so Claim 11 includes all the limitations of Claim 10, as well as other limitations of particular utility. Therefore, for the above stated reasons with regard to Claim 10, Applicant submits that Claim 11 is patentably distinguished over Dankberg in view

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of Kenworthy and in further view of Langberg. Applicant respectfully requests that the Examiner withdraw the rejection of Claim 11 and pass this claim to allowance.

Summary

For the foregoing reasons, Applicant submits that Claims 1-12 are in condition for allowance, and Applicant respectfully requests such action.

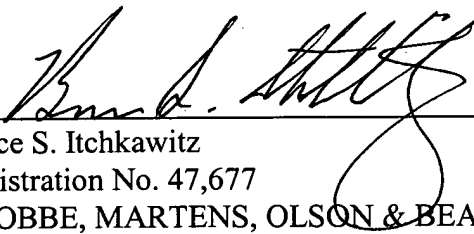
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Respectfully submitted,

Dated: _____

7/6/06

By: _____


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